

FORM PTO-1390 (Modified) (REV 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 600-3001	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.5) <div style="font-size: 1.5em; font-weight: bold; text-align: center;">09/831131</div>	
INTERNATIONAL APPLICATION NO. PCT/US00/27754		INTERNATIONAL FILING DATE 06 October 2000 (06.10.00)		PRIORITY DATE CLAIMED 07 October 1999 (07.10.99)	
TITLE OF INVENTION Confined space entry device and related method of assembly					
APPLICANT(S) FOR DO/EO/US Uni-Hoist, LLC.					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below. 4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31). 5. <input type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2)) <ol style="list-style-type: none"> a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> has been communicated by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)). <ol style="list-style-type: none"> a. <input type="checkbox"/> is attached hereto. b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> have been communicated by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). 10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)). 11. <input type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409). 12. <input type="checkbox"/> A copy of the International Search Report (PCT/ISA/210). 					
Items 13 to 20 below concern document(s) or information included:					
<ol style="list-style-type: none"> 13. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 15. <input type="checkbox"/> A FIRST preliminary amendment. 16. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 17. <input type="checkbox"/> A substitute specification. 18. <input type="checkbox"/> A change of power of attorney and/or address letter. 19. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825. 20. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4). 21. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4). 22. <input checked="" type="checkbox"/> Certificate of Mailing by Express Mail 23. <input type="checkbox"/> Other items or information: 					

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.5) <div style="font-size: 2em; font-weight: bold; margin-top: 5px;">097/831131</div>		INTERNATIONAL APPLICATION NO. <div style="font-weight: bold; margin-top: 5px;">PCT/US00/27754</div>		ATTORNEY'S DOCKET NUMBER <div style="font-weight: bold; margin-top: 5px;">600-3001</div>	
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24. The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : <div style="margin-top: 5px;"> <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1000.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 <input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 </div> <div style="text-align: right; margin-top: 5px;"> ENTER APPROPRIATE BASIC FEE AMOUNT = </div>				CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$100.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	14 - 20 =	0	x \$18.00	\$0.00	
Independent claims	3 - 3 =	0	x \$80.00	\$0.00	
Multiple Dependent Claims (check if applicable).				<input type="checkbox"/>	\$0.00
TOTAL OF ABOVE CALCULATIONS				=	\$100.00
<input type="checkbox"/> Applicant claims small entity status. (See 37 CFR 1.27). The fees indicated above are reduced by 1/2.					\$0.00
SUBTOTAL				=	\$100.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).					\$0.00
TOTAL NATIONAL FEE				=	\$100.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).				<input type="checkbox"/>	\$0.00
TOTAL FEES ENCLOSED				=	\$100.00
				Amount to be:	\$
				refunded	\$
				charged	\$

a. ☒ A check in the amount of \$100.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-0695/73-2880. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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 REGISTRATION NUMBER
 May 4, 2001
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PTO/PCT Rec'd 18 JUN 2002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No.: 623-3001

In re Application of CHOATE, Gary E., et al.

PCT No.: PCT/US00/27754

U.S. Serial No.: 09/831,131

Examiner:

International Filing Date: October 6, 2000

Art Group:

FOR: CONFINED SPACE ENTRY DEVICE AND A RELATED METHOD OF ASSEMBLY

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, DC 20231

SIR:

<p align="center"><u>Certificate Under 37 CFR 1.8(a)</u></p> <p>I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage for First-Class Mail in an Envelope addressed to: Assistant Commissioner for Patents, Washington DC 20231</p> <p>on: <u>JUN 1 2002</u></p> <p>by: <u>Ellen Weiler</u></p> <p>Name: <u>ELLEN WEILER</u> (printed)</p>
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Please amend this patent application as follows and examine the application in view of the amendments and remarks provided.

AMENDMENTS

IN THE CLAIMS:

Please cancel claims 1-15 and substitute the following claims:

- 1 16. (Newly added) A man-rated device to which a person is removably secured, the device for
- 2 use with an associated structure which the person intends to access, the device comprising:
- 3 multiple, modular components dimensioned to be man-rated when
- 4 assembled, the components including a base and at least one, elongated,
- 5 substantially cylindrical member, the base having an element adapted to be mounted in
- 6 operative proximity to the associated structure, the member formed substantially from at
- 7 least one material selected from the group consisting of aluminum, carbon fiber
- 8 composites, KEVLAR fibers, fiberglass, and aluminum-ceramic composites;
- 9 the member having one end removably secured to the base
- 10 without being welded thereto, the other end of the member having means for removably

11 securing a person thereto, whereby the components can be readily assembled and
12 disassembled;

13 the combined weight of the components being less than the corresponding
14 weight if the components were formed of steel.

1 17. (Newly added) The device of claim 16, wherein the device comprises a transformer-type
2 device with the member extending substantially vertically from the base, the member being
3 formed substantially of a carbon-fiber composite.

1 18. (Newly added) The device of claim 16, wherein the ends of the member include a
2 reinforced portion to increase the strength of the member under compressive loads.

1 19. (Newly added) The device of claim 18, wherein the reinforced portion comprises an insert
2 at the end of the member secured to the base.

1 20. (Newly added) The device of claim 17, wherein the member comprises a tube, and further
2 comprising an extension mast telescopically received in the tube, and a hoisting means
3 removably secured to the extension mast.

1 21. (Newly added) The device of claim 16, wherein the base is substantially cast and
2 substantially free of welded components.

1 22. (Newly added) A man-rated device to which a person is removably secured, the device
2 for use with an associated structure which the person intends to access, the device comprising:

3 multiple, modular components dimensioned to be man-rated when
4 assembled, the components including a base having an element adapted to be
5 mounted in operative proximity to the associated structures;

6 wherein the modular components further include multiple elongated members and
7 at least one joint section, the joint section including an elbow having two legs extending
8 outwardly at an angle from a central axis, the elongated members including a post and an
9 extension arm, the extension arm having a proximal end and a free end;

10 wherein one leg of the elbow is removably secured to one of the ends of
11 the post without being welded thereto, and the other leg of the elbow is removably
12 secured to the proximal end of the extension arm without being welded thereto,
13 the free end of the extension arm being spaced a lateral distance from the post to

the components being removably interconnected without welding between the components, whereby the components can be readily assembled and disassembled.

27. (Newly added) The device of claim 26, wherein the tubes are formed of at least one material selected from the group consisting of aluminum, carbon fiber composites, KEVLAR fibers, fiberglass, and aluminum-ceramic composites.

28. (Newly added) The device of claim 26, wherein the tubes further include additional tubes which are interchangeable with either the post, the extension arm, or both, the additional tubes having lengths differing from the lengths of either the posts or the extension arms, or both.

29. (Newly added) The device of claim 26, wherein the elbow and the base are cast metal, the two tubes, the elbow, and the base having mating ends to be fixedly and non-telescopically secured to each other.

30. (Newly added) The device of claim 26, wherein the elbow is asymmetric, making one of the legs into a shorter leg, and the other of the legs into a longer leg, each of the legs terminating in respective leg ends, each of the leg ends being able to removably fit in either the proximal end of the extension arm or the end of the post, whereby the elbow is reversible, the free end of the extension arm defining a first offset when the extension arm is secured to the shorter leg, and defining a second offset, longer than the first offset, when the extension arm is secured to the longer leg.

31. (Newly added) A davit assembly for use with a confined space entry device with a base and means for hoisting loads, the davit assembly comprising:

a substantially vertical post member having a first end removably secured to and slidably engaged in the base and extending outwardly therefrom and terminating in a second end;

an extension arm having a proximal end removably secured to and slidably engaged in one of the leg ends of the elbow, the extension arm extending from the elbow and terminating in a free end, the other leg end of the elbow being removably secured to and slidably engaged in the second end of the post; and

an asymmetric elbow having a longer leg and a shorter leg, each of the legs adapted to slidably engage and be removably secured to either one of the posts and

12 the extension arm, the elbow being reversible to locate the free end of the extension arm
13 in first and second respective offset distances from the post; and
14 a nose assembly removably secured to and having a portion slidably
15 engaged in the free end of the extension arm;
16 wherein the post and the extension arm are formed substantially from
17 non-metal, fiber polymer matrix composite material.

REMARKS

The following Preliminary Amendment removes unclear or ambiguous language prior to the Examination.

Respectfully submitted,

Date: June 7, 2002


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CLEAN COPY OF CLAIMS

1 16. A man-rated device to which a person is removably secured, the device for use with an
2 associated structure which the person intends to access, the device comprising:

3 multiple, modular components dimensioned to be man-rated when
4 assembled, the components including a base and at least one, elongated,
5 substantially cylindrical member, the base having an element adapted to be mounted in
6 operative proximity to the associated structure, the member formed substantially from at
7 least one material selected from the group consisting of aluminum, carbon fiber
8 composites, KEVLAR fibers, fiberglass, and aluminum-ceramic composites;

9 the member having one end removably secured to the base
10 without being welded thereto, the other end of the member having means for removably
11 securing a person thereto, whereby the components can be readily assembled and
12 disassembled;

13 the combined weight of the components being less than the corresponding
14 weight if the components were formed of steel.

1 17. The device of claim 16, wherein the device comprises a transformer-type device with the
2 member extending substantially vertically from the base, the member being formed substantially
3 of a carbon-fiber composite.

1 18. The device of claim 16, wherein the ends of the member include a reinforced portion to
2 increase the strength of the member under compressive loads.

1 19. The device of claim 18, wherein the reinforced portion comprises an insert at the end of
2 the member secured to the base.

1 20. The device of claim 17, wherein the member comprises a tube, and further comprising an
2 extension mast telescopically received in the tube, and a hoisting means removably secured to the
3 extension mast.

1 21. The device of claim 16, wherein the base is substantially cast and substantially free of
2 welded components.

1 22. A man-rated device to which a person is removably secured, the device for use with an
2 associated structure which the person intends to access, the device comprising:

multiple, modular components dimensioned to be man-rated when assembled, the components including a base having an element adapted to be mounted in operative proximity to the associated structures;

wherein the modular components further include multiple elongated members and at least one joint section, the joint section including an elbow having two legs extending outwardly at an angle from a central axis, the elongated members including a post and an extension arm, the extension arm having a proximal end and a free end;

wherein one leg of the elbow is removably secured to one of the ends of the post without being welded thereto, and the other leg of the elbow is removably secured to the proximal end of the extension arm without being welded thereto, the free end of the extension arm being spaced a lateral distance from the post to define an offset;

the post having one end removably secured to the base without being welded thereto, whereby the components can be readily assembled and disassembled;

wherein the post and the extension arm are formed of at least one material selected from the group consisting of aluminum, carbon fiber composites, KEVLAR fibers, fiberglass, and aluminum-ceramic composites.

23. The device of claim 22, wherein the multiple elongated members comprise additional elongated members which are interchangeable with either the post, the extension arm, or both, the additional elongated members having lengths differing from the length of either the post or the extension arm.

24. The device of claim 23, wherein the additional elongated members comprise interchangeable extension arms having fixed lengths, the fixed lengths selected to range between 18" and 48".

25. The device of claim 22, wherein the elbow is asymmetric, making one of the legs into a shorter leg, and the other of the legs into a longer leg, each of the legs terminating in respective leg ends, each of the leg ends being able to removably fit in either the proximal end of the extension arm or the end of the post, whereby the elbow is reversible, the free end of the extension arm defining a first offset when the extension arm is secured to the shorter leg and

[illegible]

1 26. A man-rated, confined space device, comprising:

multiple, modular components dimensioned to be man-rated when assembled, the components including:

4 a base with a structure adapted to be mounted in operative
5 proximity to the confined space;

6 at least two tubes, one of the tubes comprising a post, and the other
7 of the tubes comprising an extension arm;

8 an elbow between the post and the extension arm, and

9 means for hoisting loads into and out of the confined space;

10 the components being removably interconnected without welding between the
11 components, whereby the components can be readily assembled and disassembled.

1 27. The device of claim 26, wherein the tubes are formed of at least one material selected
2 from the group consisting of aluminum, carbon fiber composites, KEVLAR fibers, fiberglass,
3 and aluminum-ceramic composites.

1 28. The device of claim 26, wherein the tubes further include additional tubes which are
2 interchangeable with either the post, the extension arm, or both, the additional tubes having
3 lengths differing from the lengths of either the posts or the extension arms, or both.

1 29. The device of claim 26, wherein the elbow and the base are cast metal, the two tubes, the
2 elbow, and the base having mating ends to be fixedly and non-telescopically secured to each
3 other.

30. The device of claim 26, wherein the elbow is asymmetric, making one of the legs into a shorter leg, and the other of the legs into a longer leg, each of the legs terminating in respective leg ends, each of the leg ends being able to removably fit in either the proximal end of the extension arm or the end of the post, whereby the elbow is reversible, the free end of the extension arm defining a first offset when the extension arm is secured to the shorter leg, and defining a second offset, longer than the first offset, when the extension arm is secured to the longer leg.

31. A davit assembly for use with a confined space entry device with a base and means for hoisting loads, the davit assembly comprising:

a substantially vertical post member having a first end removably secured to and slidably engaged in the base and extending outwardly therefrom and terminating in a second end;

an extension arm having a proximal end removably secured to and slidably engaged in one of the leg ends of the elbow, the extension arm extending from the elbow and terminating in a free end, the other leg end of the elbow being removably secured to and slidably engaged in the second end of the post; and

an asymmetric elbow having a longer leg and a shorter leg, each of the legs adapted to slidably engage and be removably secured to either one of the posts and the extension arm, the elbow being reversible to locate the free end of the extension arm in first and second respective offset distances from the post; and

a nose assembly removably secured to and having a portion slidably engaged in the free end of the extension arm;

wherein the post and the extension arm are formed substantially from non-metal, fiber polymer matrix composite material.

**CONFINED SPACE ENTRY DEVICE AND RELATED METHOD OF
ASSEMBLY**

Technical Field

The present invention relates to a confined space entry and high-height
5 anchorage device and a related method of assembly.

Background Art

Confined space entry products and devices are currently used in many
applications requiring "man rated" lifting and lowering capabilities as described by
OSHA and ANSI Regulations. These devices are typically rigid structures that must
10 be carried manually to a work site and erected for a specific use. Typical uses are
entry into manholes, tank manways, over the edges of walking/working surfaces, off
the edges of power transformers, over bridge edges, into chimneys and flues, into
underground tunnels, and any other locations where entry is made difficult due
especially to space constraints.

15 Since these devices generally need to be packed, transported, and carried
manually to a desired site, it is particularly advantageous for the devices to be highly
portable and lightweight. Current construction of these products is generally by
welding of lightweight aluminum, steel, or other metal alloys. The parts or
components are produced in sections that can be separated for crating and movement,
20 but critical load-bearing sections, such as elbows, offsets, and bases are generally
produced using welded, ribbed, structures in order to carry the loads prescribed by
OSHA regulations. The use of such designs produces heavy sections that are
cumbersome to move and assemble; other, lighter designs are often inadequate to
carry the required loads for many applications.

25 A confined space entry device is used in a variety of applications, in spaces of
varying dimensions or varying space constraints. For example, different applications
or varying field conditions may require the arm of the device to be "offset" from the
vertical post or mast by different amounts. Under the current art, in order to vary such

offset, multiple, cumbersome pieces generally need to be brought to the site and kept available, and cumbersome manipulations are required before the offset can be changed.

In some applications, it is also desirable for confined space entry devices to absorb a certain amount of force generated by a person arresting a fall while using the device. For example, for certain applications it is advantageous to absorb the force of a 220-pound person arresting a six-foot fall on a hoist line of specified characteristics, without such hoist line reaching its breaking strength. The approaches of the current art to this matter often involve cumbersome shock-absorbing solutions.

10 Disclosure of Invention

The device of the present invention is used in relation to confined spaces and high-height anchorage/tie-offs. The device can be readily assembled and disassembled in the field by virtue of its modularity, that is, by using multiple, elongated members which are removably secured to corresponding joint sections.

15 One joint section is an elbow having two legs extending outwardly at an angle from a central axis. The elongated members include a post extending from one of the elbow legs and an extension arm extending from the other of the elbow legs. The free end of the extension arm is spaced a lateral distance from the post to define an offset useful in entering or exiting confined spaces. Suitable structures for hoisting men and loads

20 into and out of the confined space are operatively connected to the device of the present invention.

According to another aspect of the present invention, a davit assembly is adapted for use with any of a variety of bases. The davit assembly and the base together comprise a confined space entry device. The davit assembly has a post and an extension arm which are formed from a non-metal, polymer matrix composite material. The post and the extension arm are interconnected by means of an elbow. The post connects to one leg of the elbow and the extension arm connects to the other leg of the elbow. The extension arm extends from the post and terminates in a free end defining an offset to the davit assembly.

The davit assembly can be equipped with a set of extension arms of varying lengths, such that the offset of the davit assembly can be correspondingly varied by merely interchanging extension arms connected to the elbow of the davit assembly.

In still another aspect of the invention, the davit assembly makes use of an asymmetric elbow, that is, an elbow with a longer leg and a shorter leg. Each of the legs is structured so that it can slidably engage and be removably secured to either one of the post and the extension arm. In this way, a single extension arm can be used to create two, different offset lengths, depending on whether the extension arm is connected to the longer leg of the elbow or the shorter leg of the elbow.

10 **Brief Description of the Drawings**

Figure 1A is an isometric view of a confined space entry and high height anchorage/tie-off device, illustrating one preferred embodiment of the present invention;

Figures 1B and 1C are enlarged sectional views of the securing location of the extension arm shown in Figure 1A;

Figure 2 is an isometric view of a transformer-type confined space entry device, illustrating another preferred embodiment of the present invention;

Figure 3A is an exploded, side elevational view of another confined space entry device, illustrating still another preferred embodiment of the present invention;

Figures 3B and 3C are partial views of alternative joints for the embodiment shown in Figure 3A;

Figures 4A through 4D are top plan views of a variety of base configurations available for the confined space entry devices of the present invention;

Figures 4E through 4G are top plan and side elevational views of base configurations available for transformer-type confined space entry and high height anchorage/tie-off devices;

Figure 5 is an enlarged, sectional view of a base joint according to the present invention;

Figures 6A through 6E are side elevational views of a modular davit assembly according to the present invention;

Figures 7 and 8 are side and front elevational views of an elbow according to still another aspect of the present invention; and

Figures 9 and 10 are perspective views of a davit assembly incorporating the elbow of Figures 7 and 8 therein.

5 Modes for Carrying out the Invention

Referring to Figures 1A to 5, a confined space device, according to one preferred embodiment of the present invention, includes an "X" base frame 10 having four legs 12 connected to a vertical elongated section, post, or mast 14 through the use of a cast "X" base frame 10. Confined space devices often are used to provide high
10 height anchorage or tie off; accordingly, in this application, the use of the term "confined space entry device" or "confined space device" includes the possibility of using such devices for high height anchorage.

The cast "X" base frame 10 receives leg tubes 12 by slidably inserting leg ends into corresponding openings in the cast "X" base joint 16. The vertical elongated
15 section 14 of the structure extending vertically from the cast "X" base 10 terminates in an upper end which is slidably received in a corresponding structure in cast elbow 18. The opposing ends of elbow 18 and post or mast 14 are preferably joined in a manner similar to that used to connect post or mast 14 to base 10 frame.

Extension arm 22 extends from the other end of elbow 18, and the horizontal
20 component of extension arm 22 defines an "offset" relative to the post or mast 14.

The vertical elongated section 14 is pivotable in the "X" base 10 and will swivel 360° without interruption. The offset extension arm 22 extending from the elbow 18 is interchangeable with a variety of lengths of tubing, defining a set of extension arms, to create a corresponding set of offset distances available to the user
25 of the device. Similarly, the vertical elongated section 14 is interchangeable with a variety of lengths of tubing to create variety of different heights of the system. Further, the leg sections 12 are replaceable in the "X" base 10 with tubing of alternate lengths, defining a set of legs 12, so that the device can be equipped with whatever base dimensions and leg length required for stability. The top of each leg contains a
30 leveling screw 24 to level the structure in its preferred embodiment. Each leg end

may also contain a wheel 32, which can be used to make the system mobile on flat surfaces. A retractable device 26 is attached to the vertical elongated section 14 to provide an anchorage for the worker. Other hoists and anchorages may also be attached to the device of the present invention, such as to the U bracket 28.

5 All tubing sections and joints in the system can be disassembled and loaded into carrying cases for easy transport to a work area whether elevated or not. This eliminates long sections with bends as is necessary on welded metal davits.

Referring more particularly to Figure 2, a transformer-type confined space device includes a mast 46 extending from a cast base 44. The mast is preferably
10 made of composite fiber, as discussed in more detail below. The cast base contains adjusting screws 48 that can be used to adjust the mast from side to side. A pivotal ring 50 at the top of the mast 46 allows the workers to attach to the mast by snapping into the rings 52. All three rings are joined in one plate and swivel as a unit around the mast 46. An additional extension mast 54 may be inserted into the vertical mast
15 46 and used to anchor a hoist 56 for the added purpose of lifting or lowering a person or materials attached to the safety line 58 at the snap 60. Note that to assemble the transformer davit in this configuration requires no welding, only slip together, pre-made sections made by the previously mentioned methods and processes.

Additionally, a boom mount hoist may be anchored to one of the attachment points in
20 the pivotal ring 52 as an additional method for using a rescue hoist.

Figure 3A illustrates the elbow 18 of Fig. 1A in the context of another embodiment of the present invention. In particular, offset extension arm 22, in the form of a tube, is inserted over an end of the elbow 18. Mast 68 in this embodiment includes rigid sleeve inserts 40 to control dimension, add stiffness, and reduce stress
25 at the joint with base 76 and reduce the risk of crushing mast 68 under compressive loads. Additionally, Figure 3A shows hoist mount 62 and the retractable mount 64 for use in handling loads secured to the device. A cable extends from the free end of extension arm 22. Reeving of this cable is shown through the nose assembly 66.

Offset extension tube 22, vertical post or mast tube 68, leg tube 70, and other
30 elongated members of the device can be formed of aluminum, aluminum composite or

carbon-composite material. The devices of Figures 1 through 5 include davit assemblies extending from bases, and such bases are provided with leveling screws 72 and casters 74 to enable ease of positioning once assembled. The composite fiber legs 70 are slidable through the "H" base frame 76.

5 Figure 3B shows a variation on attachment of the extension tube 22 to elbow 18. In order to avoid distortion of the tube due to stress at the elbow exit point 34, a rigid sleeve 36 has been inserted into the tube 22. Referring to Fig. 3C, special high-strength inlays and additional fiber reinforcement may be added to this area 38 to increase strength and improve stiffness. Rigid sleeve inserts 140 are added to control
10 dimension, add stiffness, and reduce stress at exit area 42.

Referring now to Figure 5, an "H" base support is shown with details of the tube inserts similar to those shown in Figure 3B. Experience has shown that the tubing of the elongated members can be crushed by high compressive loads that are encountered against rigid supports. To overcome this problem and allow the
15 composite fiber or aluminum tube to absorb the maximum amount of energy, rigid inserts 92 and 94 are secured at joint 88 at selected locations. In Figure 5, the "H" base is shown supporting the composite fiber tube 82 inside a sleeve 84 against elastomer bearing 86. When a side load is placed on the composite fiber or aluminum tube, excessive compressive loads can be created at 88 and 90. To keep the tube from
20 crushing, rigid inserts 92 and 94 are attached to the inside of the tubing by gluing or pinning. The inserts are located at the base of each tube and at each transitional location such as the exit from a support 96. Similar inserts are useful at other joints of the device.

Referring now to Figures 4A through 4G, composite fiber, aluminum, or
25 aluminum composite tubes 70, 82 can be used with corresponding joints or sections to form a variety of different bases for the confined space device, namely: an X base (Fig. 4A), an H base (Fig. 4B), a modified X base (Fig. 4C), a triangle base (Fig. 4D), a fixed transformer base (Fig. 4E), a pivotal transformer base (Fig. 4F), and a swivel base for transformers (Fig. 4G).

In one preferred aspect of this invention, the elongated of the device members shown in Figs 1A through 5 are tubes formed from composite materials. The elongated members formed from composite material include extension tube 22, post or mast tube 68, and leg tube 70. Composite materials include lightweight carbon fiber, kevlar fiber, fiberglass and lightweight aluminum-ceramic composites. The preferred composite material is chosen to be sufficiently elastic to absorb forces of a person arresting a predetermined free fall, but sufficiently resilient to deform and still return to its original position.

This combination of plug-in sectional assembly and super-light weight, highly elastic, composites with up to ten times the strength of previous materials enables this invention to be used as a highly portable confined space and fall arrest product in spaces and geometric load-bearing arrangements previously unobtainable by any prior art.

With the ability of the composite fiber structures to deform significantly under stress, it gives them the ability to absorb significant amounts of fall arrest energy. This energy can be determined by using the equation:

$$E = \frac{1}{2} T \times D$$

Where:

T = maximum fall arrest line tension

D = structural deflection

It has been shown by testing that a structural deflection of 10.5 inches is possible with a fall arrest line tension of 3000 lbs. This means that the anchorage structure can absorb as much as:

$$E = \frac{1}{2} (3000 \text{ LBS.}) \times (10.5 \text{ in.}) \times (1 \text{ ft./12 in.}) = 1312.5 \text{ ft-lbs.}$$

of energy. A 220-lb. person falling 6-ft. (per OSHA regulations limiting free-fall distances) can generate:

$$E = (220 \text{ lbs.}) \times (6 \text{ ft.}) = 1320 \text{ ft-lbs.}$$

On preferred composite material is a polymer matrix composite material suitable for absorbing energy in the amounts indicated above, while remaining

1 sufficiently resilient. More particularly, the elongated members of the device
comprise a filament-wound carbon fiber tube that is an epoxy-based, non-isotropic
composite structure formed from pre-preg sheet goods. Tubes from such material
have walls with a thickness of 0.120 inches. Other composite materials suitable for
5 forming elongated members of the device have the following general characteristics:
the resulting members are between eight to twelve times as strong as equivalent
aluminum tubing, able to withstand between two to four times the stress of typical
aluminum tubing, and retains a high modulus of elasticity.

Use of composite materials allows extension arms of the present invention to
10 have greater lengths, thereby giving a greater selection of offsets to confined space
entry device of the present invention. Composite material also absorbs increasing
amounts of energy with increasing length. Testing has shown that the length of post
members, such as the mast 46 of Fig. 2, can satisfy predetermined strength and fall
arrest characteristics even at heights up to 72 inches, whereas conventional systems
15 were required to be much shorter, on the order of 42 inches, to satisfy the same
requirements. Similar tests have shown that use of composite material reduces arrest
forces by one-third in many applications.

As such, the composite tubes greatly increase worker safety. It provides
backup security so that if the worker should fall while attached to the structure
20 without using a sufficient shock absorbing lanyard, the structure itself can absorb
enough energy to reduce the chances of the lanyard line and anchorage structure
failing.

Joint sections are preferably locked with thru bolts 30 or detent pins 130, as
shown in Figs. 1B and 1C, respectively, or by ball-lock pins, ball detents (not shown),
25 or other suitable means such as screwing, gluing, etc.

The detachable components of the confined space entry device of Figs. 1-5,
that is, base 16, leg tubes 12, post tube 14/68, elbow 18, and extension tube 22, may
alternatively be made of cast aluminum or cast composite fiber, extruded aluminum,
aluminum composite, or injection molded of composite fibers, plastics, or metals, or
30 made by a composite fiber lay-up molding process as described in the following U.S.

the current art. As such, the user can be equipped with a set of different-length extension tubes and merely needs to carry these different tubes along with the balance of the davit assembly 111 to the field. Where so equipped, the user can readily vary the structure of the davit assembly "on the fly," as different applications demand
5 different "offsets."

Figs. 7-10 illustrate another preferred embodiment of the present invention. In this embodiment, elbow 718 is preferably formed of cast metal, more preferably cast aluminum. Significantly, elbow 718 is asymmetric about its central axis 719, as shown in Fig. 7. Otherwise stated, elbow 718 has a shorter leg 721 and a lower leg
10 723, and legs 721, 723 are joined at their inside ends to give an angle α to elbow 718. Elbow 718 includes a web or gusset 725 as part of its casting and a retainer 727 for use in conjunction with hoist lines of the davit assembly.

Each of the legs 721, 723 includes outer ends 729 adapted to receive elongated, preferably tubular members. In the illustrated embodiment, the ends of
15 tubular members are received into apertures 731 defined in outer end 729.

Elbow 718 is part of a davit assembly, which in turn is part of a confined space entry device 711 similar to those illustrated in Figs. 1-6. Similar to the elbows illustrated in Figs. 1-6, elbow 718 attaches at one of its ends to the vertical or post tube 714 of the confined space device and, at its other end, to a suitable extension tube
20 722 (Figures 9 and 10). Still referring to Figs. 9 and 10, elbow 718 is shown as part of a fixed base confined space entry device 711. As in the previously described embodiments, vertical tube 714 is removably received at its lower end 731 into a suitable base 710, shown here as a bolt down or weld down base.

Referring now particularly to Fig. 9, the longer leg 723 of elbow 718 is
25 connected as its end 729 to the upper end 733 of post member 714. The opposite, shorter leg 721 of elbow 718 is oriented upwardly, and extension tube 722 is received in shorter leg 721. In the configuration shown in Fig. 9, extension tube 722 is selected so as to create a horizontal offset 735 of approximately 18 inches.

The versatility and advantages of elbow 718 are illustrated by contrasting the
30 above-described configuration of Fig. 9 with the alternate configuration shown in Fig.

10. In particular, the same components described in Fig. 9 are used to reconfigure the confined space entry device 711 in Fig. 10; however, elbow 718 is reversed, meaning its shorter leg 721 connects to upper end 733 of vertical member 731, and its longer leg 723 extends upwardly and outwardly from vertical member 714, and is connected
5 to extension tube 722.

In this way, a horizontal offset 835, shown in Fig. 10, is created, and such offset 835 is longer than the offset 735 shown in Fig. 9 by virtue of having extension 722 connected to the longer leg 723 of elbow 718. In this embodiment, longer offset 835 is approximately 24'.

10 Tubular member 714 and 722 are preferably made of lightweight material, more preferably lightweight metal, and most preferably lightweight aluminum, such as aluminum of the type 6061-T6. Alternate types of aluminum are also suitable, such as the 7000 series, including 7071, or aluminum composites, or DURALCAN material. Members 714 and 722 are 3/8 inches thick, with 3 inch outside diameters.
15 A suitable material for elbow 718 has been found to be cast alumamag 535. Legs 721 and 723 have been found suitable when joined at an angle ranging between approximately 120° and 150°, preferably approximately 140°, with leg 721 extending approximately 9 inches and leg 723 extending approximately 15.25 inches from central axis 719.

20 In addition to the advantages apparent from the foregoing description, the confined space entry devices of the present invention are more effectively "componentized" or modularized.

Such modularity has the attendant advantages of allowing users to customize the configurations of the confined space devices using a limited number of
25 interchangeable components. The asymmetric design of the elbow according to one aspect of the present invention results in variations in offsets without requiring a second extension tube or a different elbow.

The modular components of the present invention are more compact and thus more readily transportable.

When formed of a suitable composite material, the elongated extension tube absorbs forces associated with arresting of a fall. Such absorption of forces, in turn, has the advantage of reducing the risk of hoist line ruptures or other undesired deformations of the structural members of the confined space device.

- 5 It is understood that the above-described preferred embodiments are but selected illustrations of the present invention, and that further alternative embodiments may be devised by those of ordinary skill in the art. Such alternatives, as well as others which skill or fancy may suggest, are considered to fall within the scope of the current invention, which is defined by the claims appended hereto.

10 WHAT IS CLAIMED IS:

1 1. A device for use in entering or exiting confined spaces, the device comprising:

multiple elongated members removably secured to corresponding joint
sections, the joint sections including an elbow having two legs extending
outwardly at an angle from a central axis, the elongated members including a
post and an extension arm; the post having opposite ends; the arm having a
proximal end and a free end;

7 wherein one leg of the elbow is removably secured to one of the ends
8 of the post and the other leg of the elbow is removably secured to the proximal
9 end of the extension arm, the free end of the extension arm being spaced a
10 lateral distance from the post to define an offset;

the device further comprising means for hoisting loads into and out of the confined space, the hoisting means including a line operatively extending from the extension arm. 2. The device of claim 1, further comprising a nose assembly removably secured to the free end of the extension arm.

3. The device of claim 1, wherein the multiple elongated members further include additional members which are interchangeable with at least one of the post and the extension arm, the additional members having lengths differing from the lengths of the post and the extension arm.

1 4. The device of claim 3, wherein the additional members comprise interchangeable
2 extension arms having sufficient lengths to vary the offsets between lengths of 18
3 inches, 24 inches, 36 inches and 48 inches.

1 5. The device of claim 1, wherein the elongated members comprise tubes and the
2 joint sections comprise cast joints, the tubes and cast joints having corresponding ends
3 adapted to slidably engage each other.

1 6. The device of claim 5, wherein the tubes are formed of aluminum and the joints are
2 cast aluminum.

8 an extension arm having a proximal end removably secured to and
9 slideably engaged in one of the leg ends of the elbow, the extension arm

10 extending from the elbow and terminating in a free end, the other leg end of
11 the elbow being removably secured to and slidably engaged in the second end
12 of the post; and
13 an asymmetric elbow having a longer leg and a shorter leg, each of the
14 legs adapted to slideably engage and be removably secured to either one of the
15 posts and the extension arm, the elbow being reversible to locate the free end
16 of the extension arm in first and second respective offset distances from the
17 post; and
18 a nose assembly removably secured to and having a portion slidably
19 engaged in the free end of the extension arm;
20 wherein the post and the extension arm are formed substantially from a
21 non-metal, fiber polymer matrix composite material.

1 13. The assembly of claim 12, further comprising a set of the extension arms having
2 different lengths, the distance between the free end and the post defining an offset, the
3 amount of the offset being adjustable by selectively replacing the extension arm
4 secured to the elbow with another of the extension arms from the set.

1 14. A davit assembly for a confined space device having a base and means for
2 hoisting loads, the davit assembly comprising:

3 a substantially vertical post member, having a first end removably
4 secured to and slidably engaged in the base and extending outwardly
5 therefrom and terminating in a second end;
6 an asymmetric elbow having a longer leg and a shorter leg;
7 an extension arm having a proximal end removably secured to and
8 slideably engaged in one of the legs of the elbow; and
9 a nose assembly removably secured to and having a portion slidably
10 engaged in the free end of the extension arm;
11 wherein each of the legs is adapted to slidably engage and be
12 removably secured to either one of the post and the extension arm, the elbow
13 being reversible to locate the free end of the extension arm in first and second
14 respective offset distances from the post;

1. The first part of the report, which is the most important, is the introduction. This part should be written in a clear and concise manner, and should provide a brief overview of the project and its objectives. It should also include a statement of the problem being addressed, and a description of the methods used to solve the problem.



(10) International Publication Number
WO 01/24972 A2

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(22) International Filing Date: 6 October 2000 (06.10.2000)

(81) Designated States (national): AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, ME, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(30) Priority Data:		
60/158,406	7 October 1999 (07.10.1999)	US
60/190,772	20 March 2000 (20.03.2000)	US

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Clanton, AL 35045 (US).

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

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— Without international search report and to be republished upon receipt of that report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CONFINED SPACE ENTRY DEVICE AND RELATED METHOD OF ASSEMBLY

(57) Abstract: A confined space entry device has modularized components which allow the device to be readily reconfigured. In particular, the extension arm of the device is removably secured to one leg of an elbow, while a post or mast is removably secured to the other end of the elbow. The other end of the mast is removably secured to a base which supports the confined space entry device. In one version of the invention, the device includes tubular members made of a polymer composite material. In another version of the invention, the elbow is asymmetric about a central axis and is formed of cast aluminum. The device can include sets of different-length elongated members which can be interchanged with elongated members secured within the device.

WO 01/24972 A2

FIG. 1A

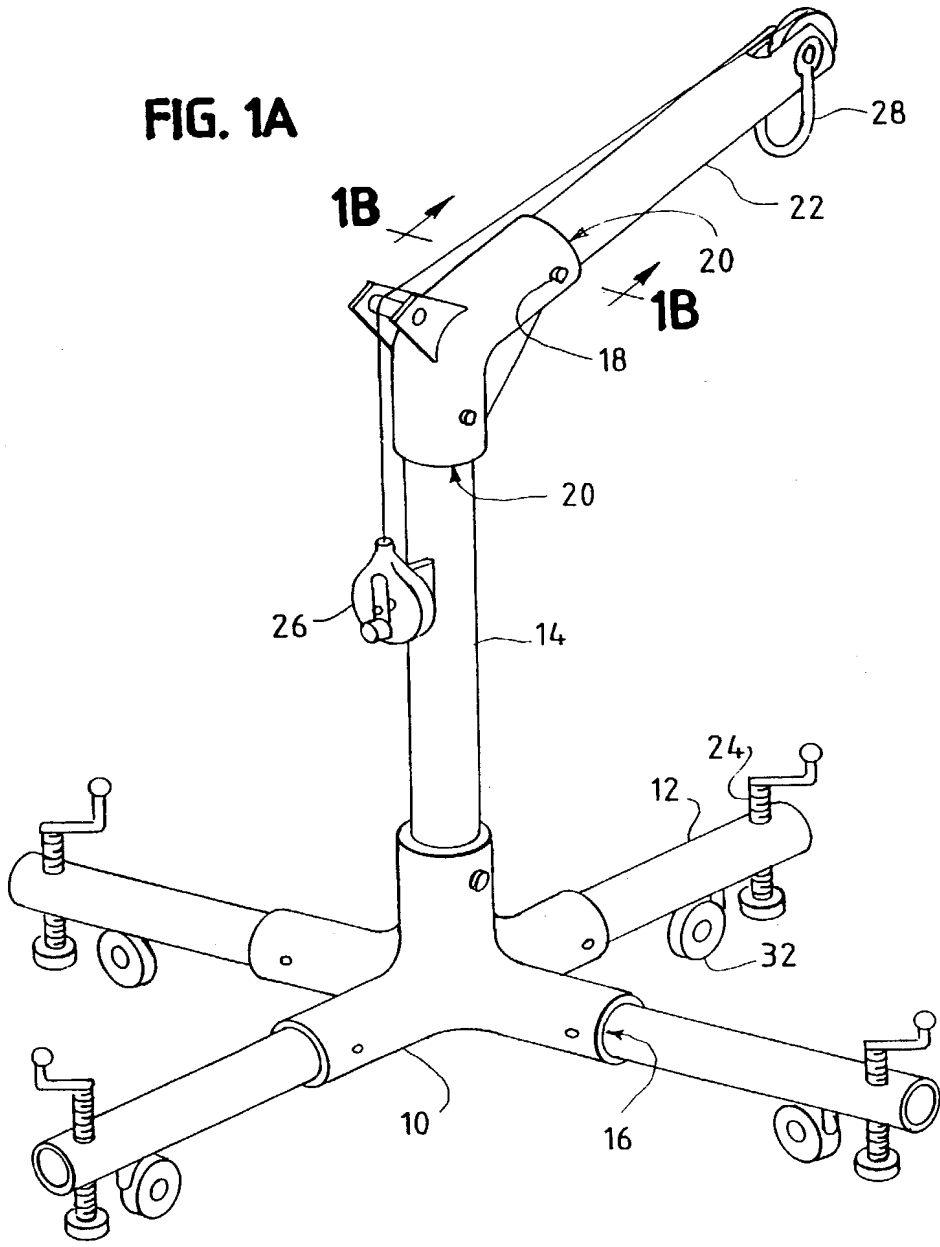


FIG. 1B

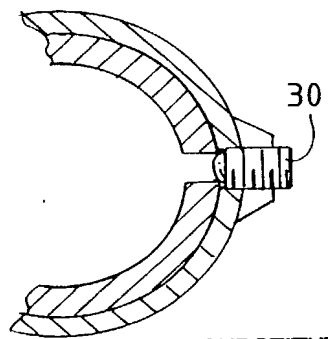
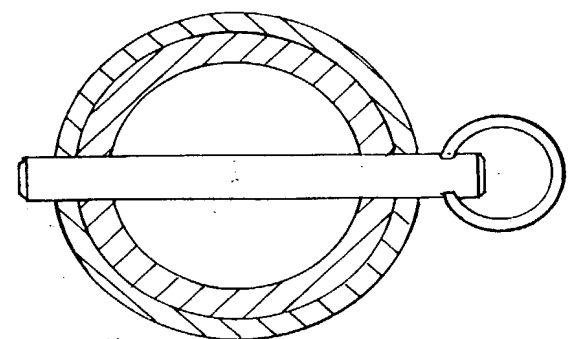
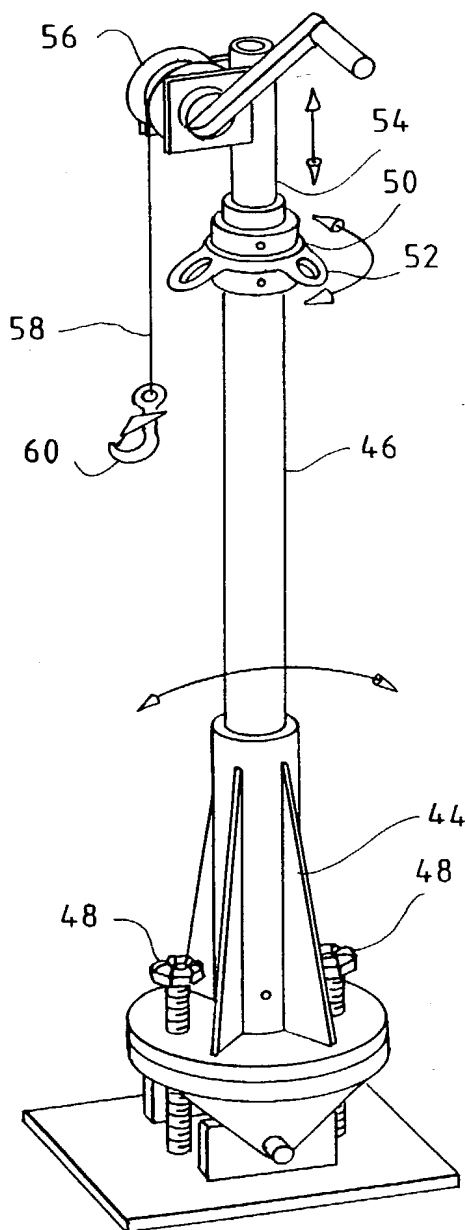


FIG. 1C



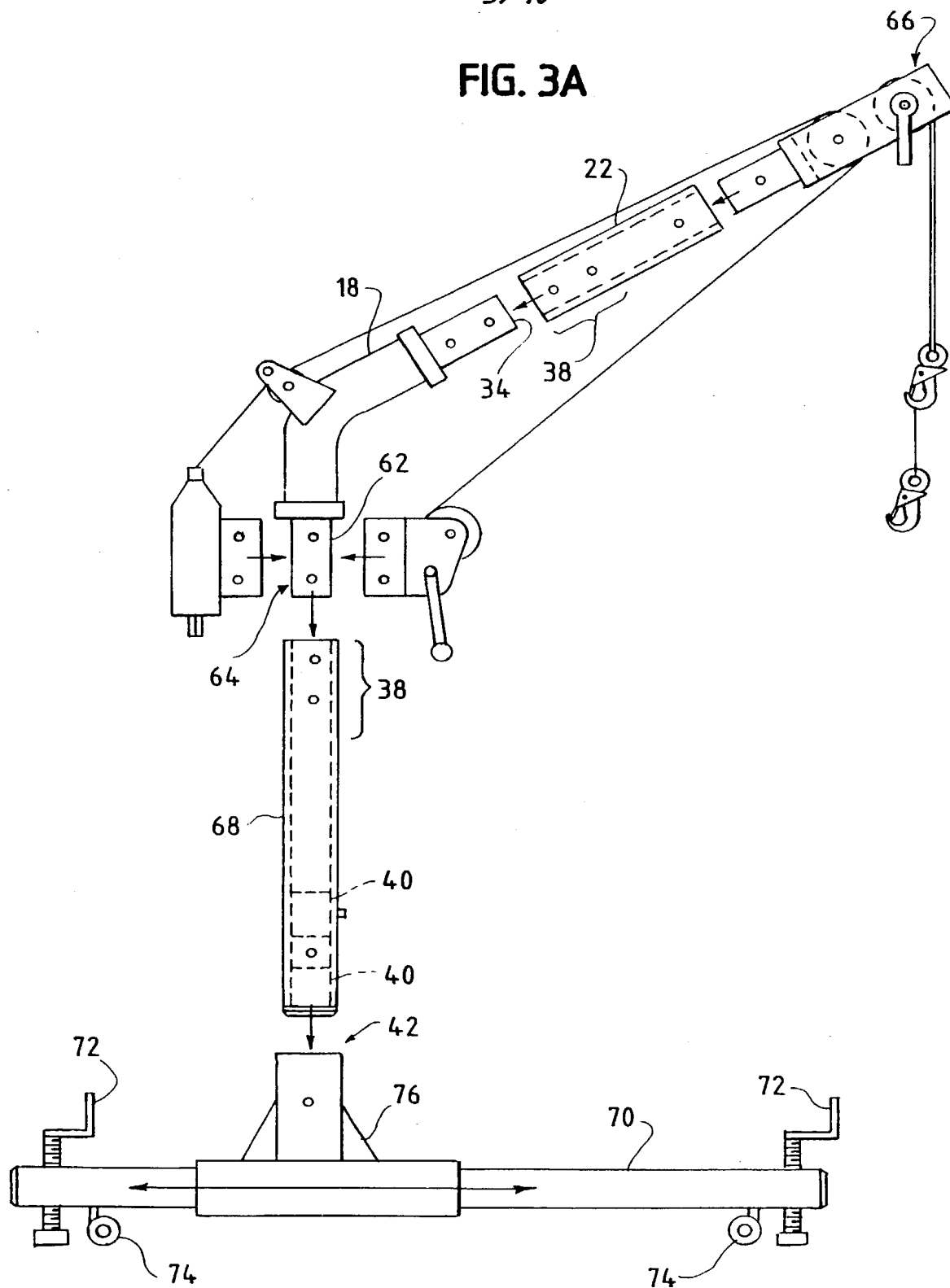
2/10

FIG. 2



3/10

FIG. 3A



4/10

FIG. 3B

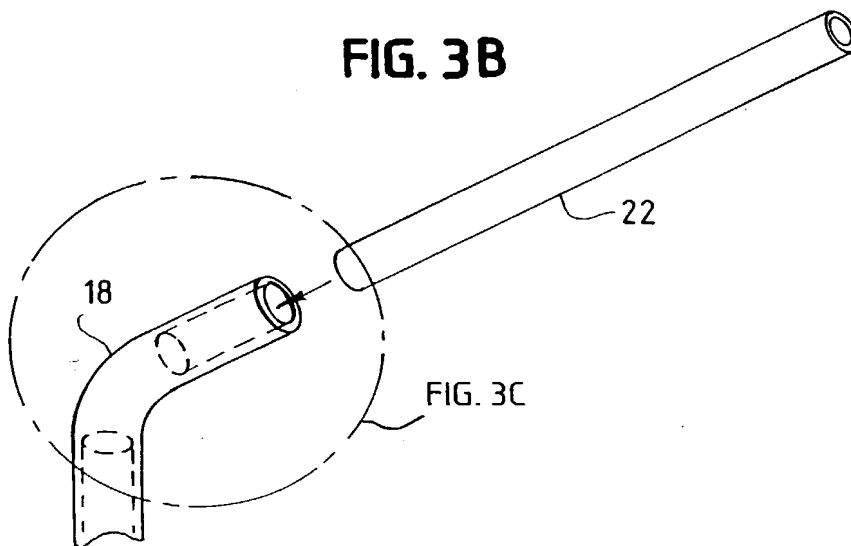


FIG. 3C

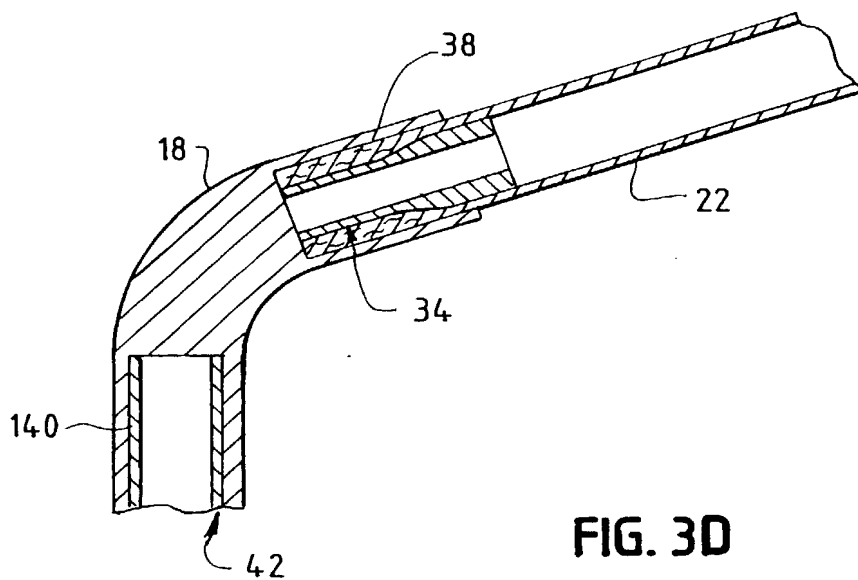
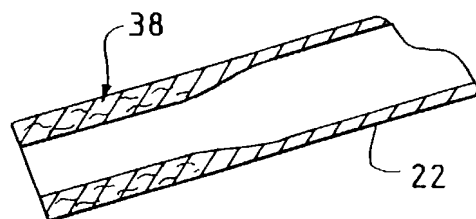


FIG. 3D



5/10

FIG. 4A

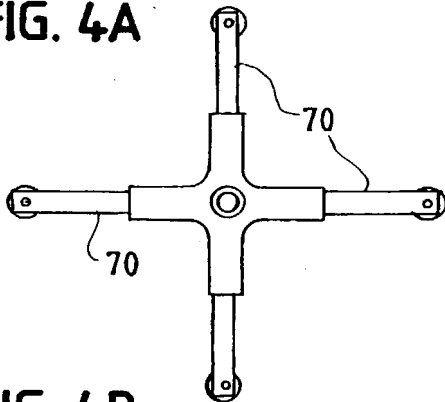


FIG. 4B

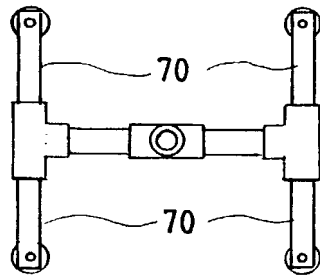


FIG. 4C

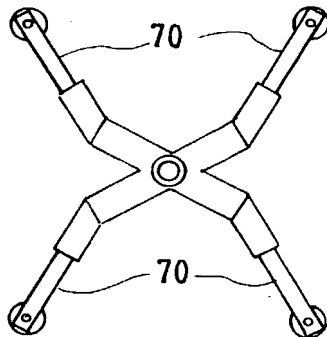


FIG. 4D

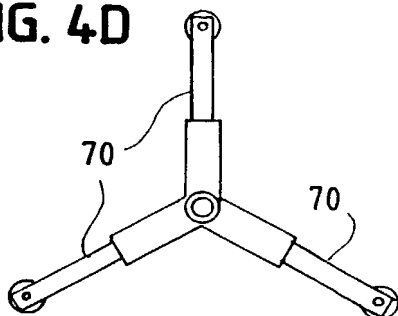


FIG. 4E

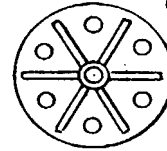


FIG. 4F

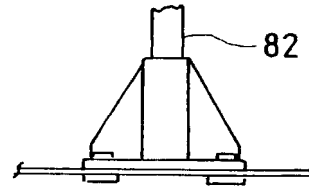


FIG. 4G

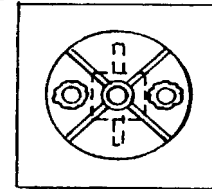


FIG. 4H

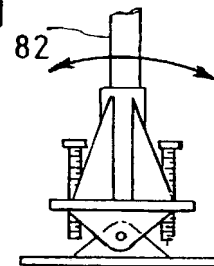


FIG. 4I

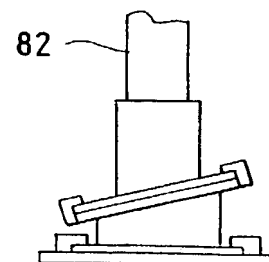


FIG. 5

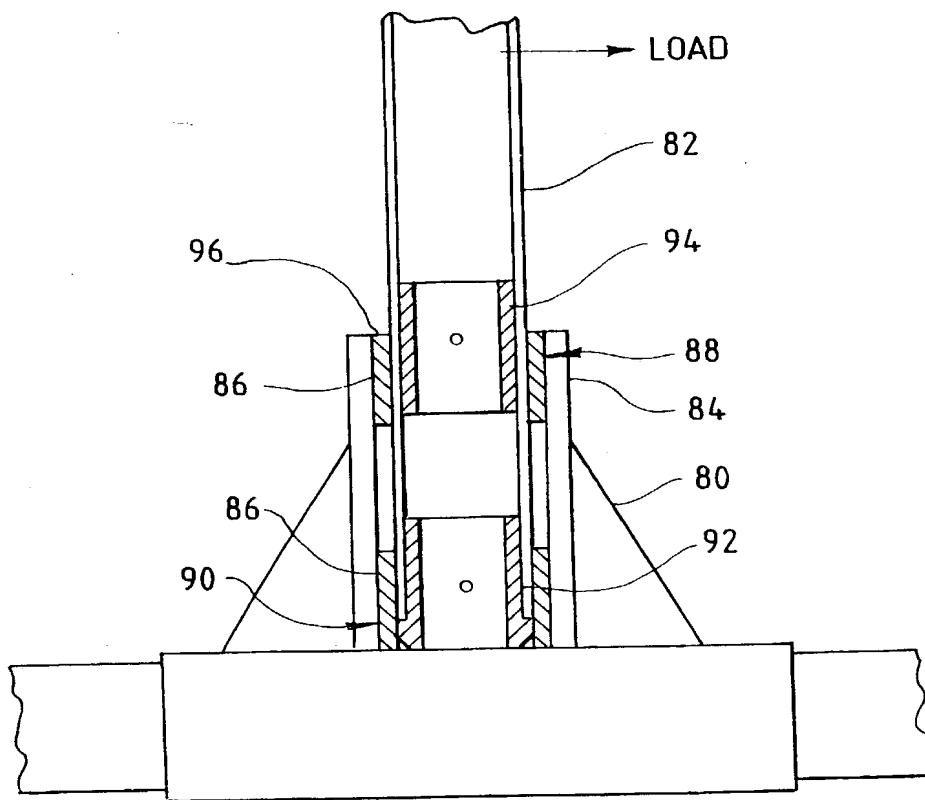


FIG. 6A

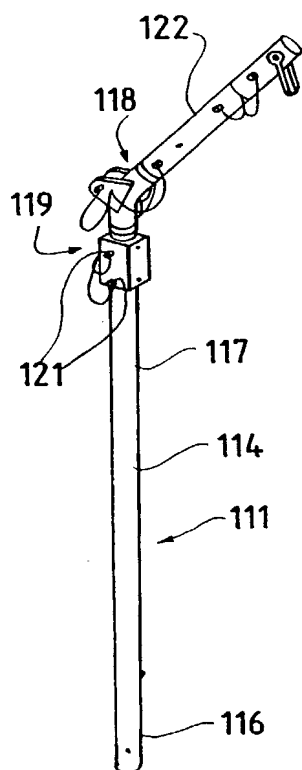


FIG. 6B

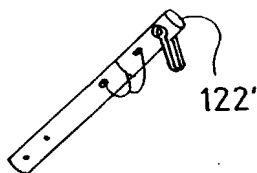
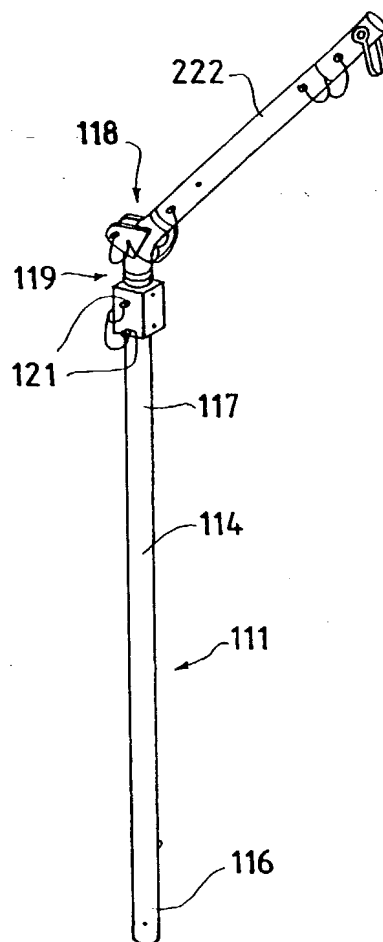


FIG. 6C



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FIG. 6D

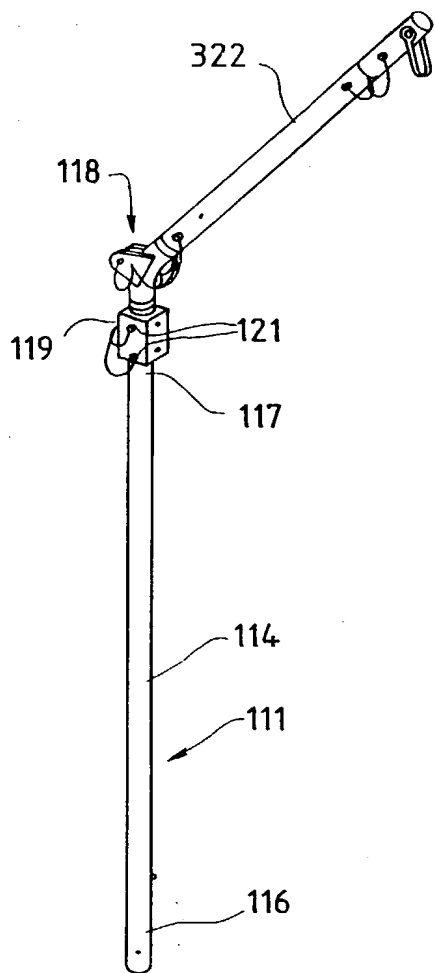


FIG. 6E

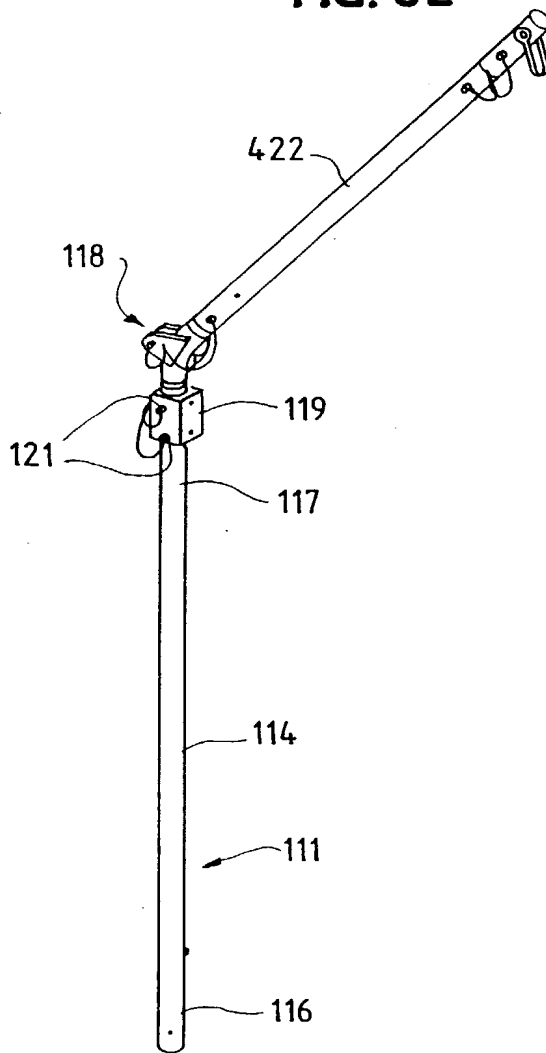


FIG. 7

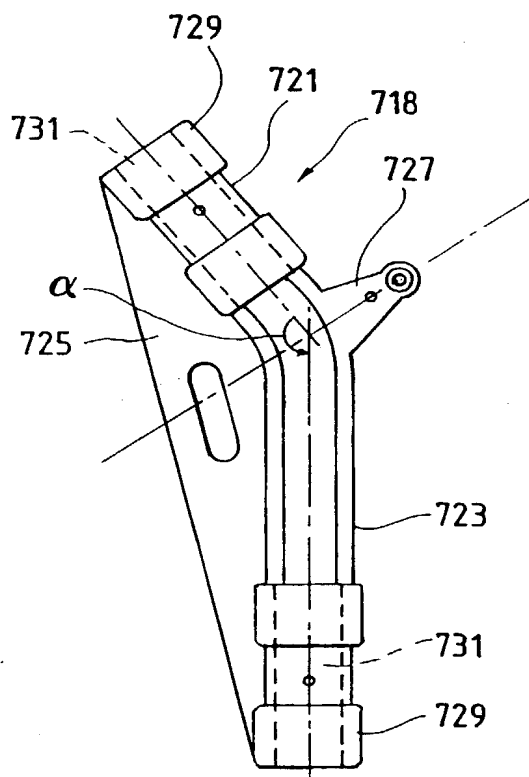


FIG. 8

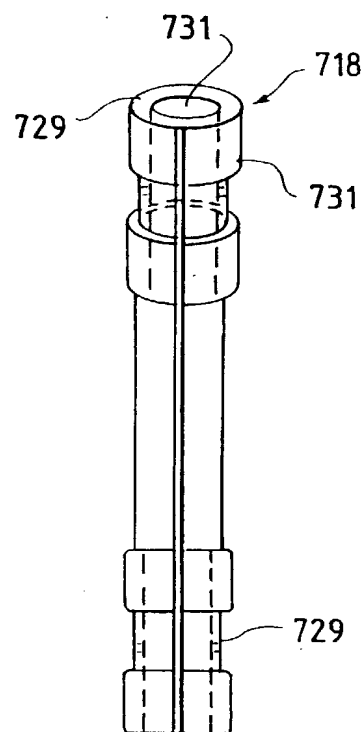


FIG. 9

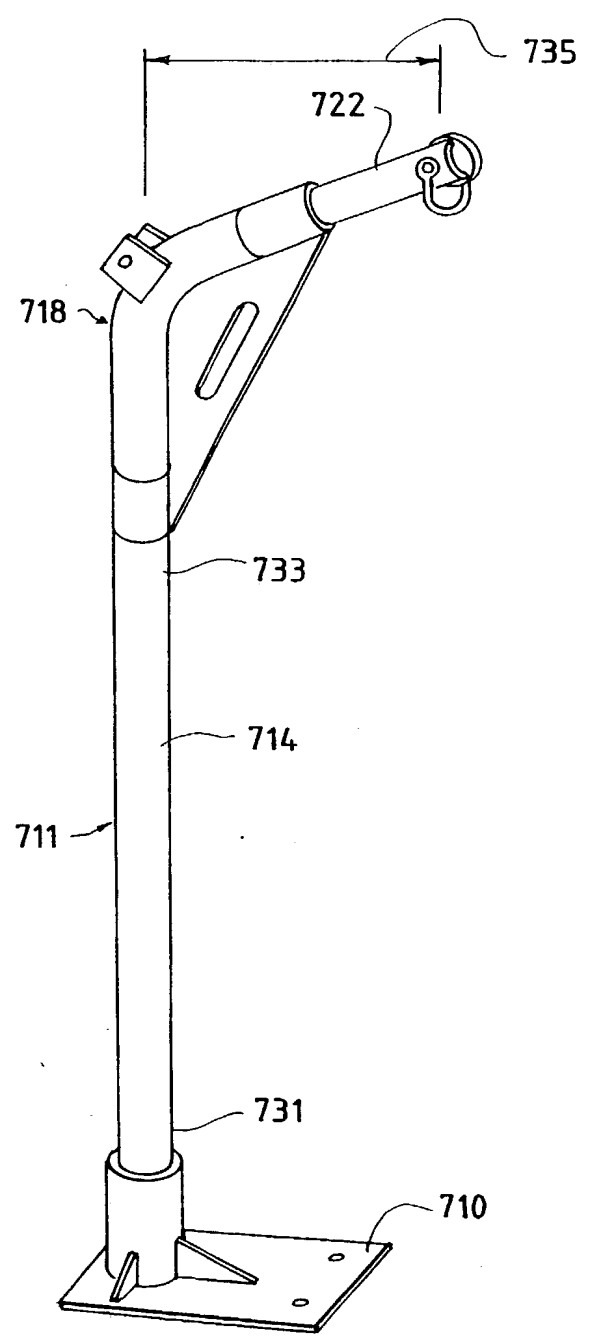
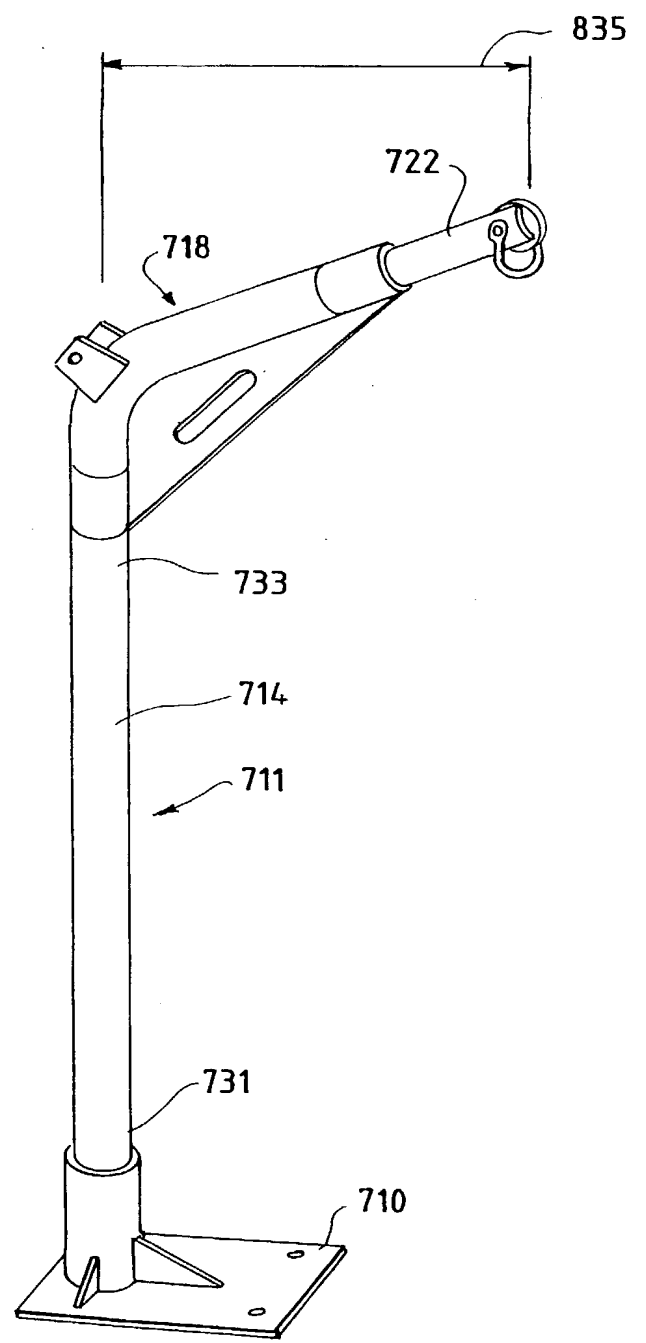


FIG. 10



PATENT

ATTORNEY DOCKET NO:

TAP007-210432

DECLARATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

CONFINED SPACE ENTRY DEVICE AND RELATED METHOD OF ASSEMBLY

the specification of which is attached herewith unless the following box is checked.

☒ was filed on June 7, 2002 as Application Serial No. _____
or PCT Application No. PCT/US00/27754 and was amended on _____
(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed:

APPLICATION NO.	PRIOR FOREIGN/PCT APPLICATION(S)	PRIORITY CLAIMED
COUNTRY	DATE OF FILING	
PCT/US00/27754	PCT	6 OCTOBER 2000
		<input checked="" type="checkbox"/> YES NO <input type="checkbox"/>
		<input type="checkbox"/> YES NO <input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

PROVISIONAL APPLICATION NUMBER	DATE OF FILING
60/158,406	7 October 1999
60/190,772	20 March 2000

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365(c) of any PCT International application(s) designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose material information as

PATENT

ATTORNEY DOCKET NO:

TAP007-210432

DECLARATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

CONFINED SPACE ENTRY DEVICE AND RELATED METHOD OF ASSEMBLY

the specification of which is attached herewith unless the following box is checked.

☒ was filed on June 7, 2002 as Application Serial No. _____
or PCT Application No. PCT/US00/27754 and was amended on _____
(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed:

APPLICATION NO.	PRIOR FOREIGN/PCT APPLICATION(S)	
	COUNTRY	DATE OF FILING
PCT/US00/27754	PCT	6 OCTOBER 2000

PRIORITY CLAIMED
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
<input type="checkbox"/> YES <input type="checkbox"/> NO

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

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defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT inter-national filing date of this application:

**PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. §120**

Status (check one)

Application Serial No. PCT	Date of Filing	Patented <input type="checkbox"/>	Pending <input type="checkbox"/>	Abandoned <input type="checkbox"/>
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FULL NAME OF SOLE OR FIRST INVENTOR

D-00

<u>Gary</u> (GIVEN NAME)	<u></u> (MIDDLE INITIAL OR NAME)	<u>Choate</u> (FAMILY OR LAST NAME)
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Date: <u>Nov. 15 - 2002</u>		
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<u>Dustin</u> (GIVEN NAME)	<u>L.</u> (MIDDLE INITIAL OR NAME)	<u>Hawkins</u> (FAMILY OR LAST NAME)
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Date: <u>Nov 19-02</u>		
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defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT inter-national filing date of this application:

**PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. §120**

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FULL NAME OF SOLE OR FIRST INVENTOR

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Inventor's signature: _____

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Edward Inman
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Inventor's signature: _____

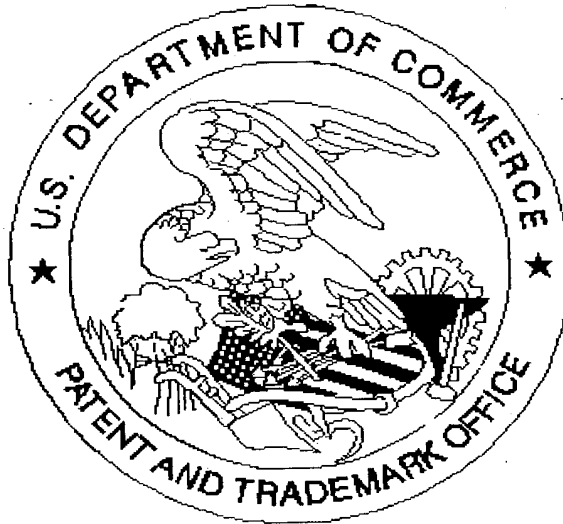
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